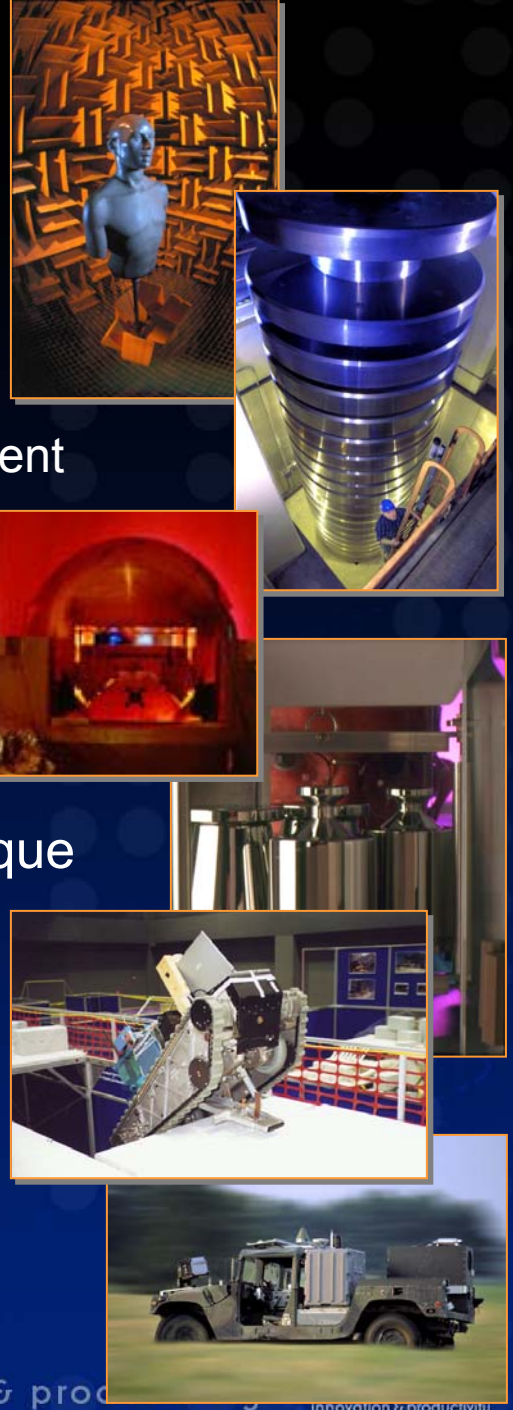

productivity
MEL
innovation & productivity
Strategic Program Planning
in the
Manufacturing Engineering
Laboratory
Dale Hall
March 7, 2006
innovation
NIST
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

MEL Snapshot

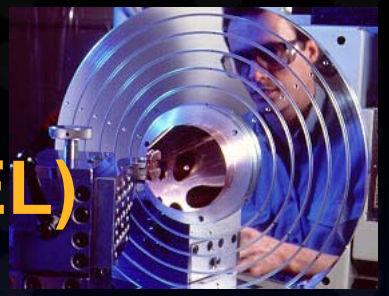
- Has core competencies in
  - Mechanical and dimensional metrology
  - Intelligent and integrated manufacturing
  - Advanced manufacturing processes and equipment
- Develops infrastructural technologies to enable innovation and productivity
- Provides critical measurement services to industry
- Is customer-focused and connected
- Has facilities that are often world-class and unique
- Leads
  - Federal Interagency Working Group on Manufacturing R&D
  - U.S. participation in IMS, an international mfg. technology collaboration
- Has 188 staff members and an operating budget of ~$43.1 million (2006 est.)



MEL Matters

- Manufacturing matters to our standard of living, quality of life, and national security
- Manufacturing is challenged by a changing world and more aggressive and adept competition
- Technology - in the form of innovation and productivity - is crucial to the success of U.S. manufacturers
- By providing critical elements of the manufacturing technology infrastructure, MEL helps manufacturers to innovate and compete more effectively

The NIST Manufacturing Engineering Laboratory (MEL)

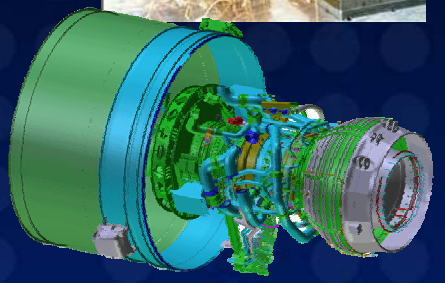


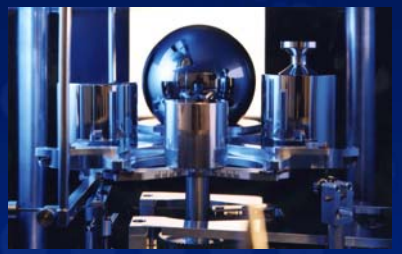
Mission

To satisfy the measurements and standards needs of US manufacturers

in mechanical and dimensional metrology and in advanced manufacturing technology

by conducting research and development, providing services and participating in standards activities





The Needs are Evident…

U.S. Manufacturing sends key messages through

- A robust trade press
- Well-organized, diverse industry associations
- Extensive, national media coverage

MEL gathers intelligence through

- Extensive involvement in manufacturing community strategic planning and related activities
- Strong and frequent interaction with key customers, collaborators, and stakeholders
- Formally managed strategic relations

The Needs Are Evident…

Disruptive Technologies: Semantic Web

by Alan Alper, MA Editorial Staff

Posted on Friday, April 22, 2005 11:08:50 AM EDT

SMB MANAGING — Are you a manufacturer with a company size of 1,000 or less employees? Click here to access our new portal *Solutions for Small to Midsize Businesses*.

It's 2010. Your company survived the economic

ARTICLE TOOLS

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DARATECH, Inc.

industry update

Vol 17 Issue 4 APRIL 2005

IT for MANUFACTURING, ENGINEERING, CONSTRUCTION AND PLANT OPERATIONS

Over 95% of all application integration projects fail, according to a 2003 study by The Standish Group International Inc. IT staffs either significantly exceed their budgets, fall behind schedule, or fail to accomplish their goals.

Current Integration Approaches: Leading to Failure

Over 95% of all application integration projects fail, according to a 2003 study by The Standish Group International Inc. IT staffs either significantly exceed their budgets, fall behind schedule, or fail to accomplish their goals.

These failures are due, in large part, to integration approaches that cannot accommodate variety and change. For example, many traditional, static approaches rely on proprietary or system-specific platforms that build-out (typically with custom code) synchronous and tightly coupled integration directly between the business process layer and the IT infra

Occasionally, pre-built adapters exist, but they often provide only hard-wired, bi-connectivity to a handful of applications and data.

From "Developing SOA Solutions to Accommodate Variety and Change - A White Paper" by Michael Hoskins, CTO, Pervasive Software

MUDDY WATERS

Lack of Interoperability Continues to Vex Manufacturing Industry; Diminishes PLM Spoils

Proliferation of Standards & Data Formats Complicate the Issue

By Tim Hickey

Manufacturing industry is abuzz with all things product lifecycle management. never-before-realized gains in manufacturing productivity: fewer physical prototypes are built now than ever before — in the

NAM National Association of Manufacturers

The NAM's Pro-Growth and Pro-Manufacturing Agenda for the 109th Congress

U.S. manufacturing generates two-thirds of R&D and three-fourths of exports and supports more than 20 … lent jobs. T… efficiency and productivity are at record levels, capital investment is rising, and product… But U.S. m… prices to keep pace with rising production costs and faces intense forei… olicies that … control keeps manufacturers in a cost-price squeeze … ail against … competition.

Last year, the U.S. Department … in a grou… "Manufacturing in America." Wo… leadersh… urgently advance policies in the …

Reduce Production Costs in t…

- Reduce health care costs … ccounts … Arrangements (HRAs), As…
- Enact sensible, cost-effecti… dates o…

Reduce Production Costs in the United States:

Reduce health care costs through better deployment of information technology, wider adoption …..

ma Managing Automation

Technology Strategies for Progressive Manufacturers

Print this document

SCADA Security -- Closing Pandora's Box

By Alan Alper

Manufacturers' belated embrace of Web-driven applications accessed via Windows-based … scenario relative to mission-critical supervisory control and data acquisition, or SCADA sys…

The goods news: Open networks can be more easily and inexpensively deployed to enable …

• inno… productivity

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The Needs Are Evident…

If these cars could talk...

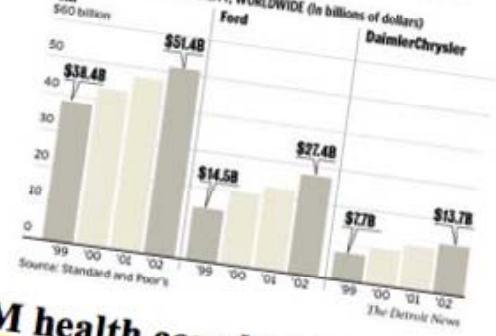
(Mar. 21, 2001) -- Think airbags are the cutting edge of driving safety? Think again. By 2003 you could drive a car that tells you you're about to hit the car in front of you or before you run off the road. By 2011, your car could warn you before another driver runs a red light - because his car told your car he would do it.

These amazing advances are coming out of the Intelligent Vehicle Initiative (IVI), part of the Intelligent Transportation Systems program - a research partnership between the automobile industry and Department of Transportation. According to ITS program these technologies could soon cut the most common up to 20 per cent.

Retiree burden

With nearly half of all UAW employees eligible to retire within five years, Detroit automakers face mounting obligations to provide medical coverage to retirees:

RETIREE HEALTH CARE LIABILITY, WORLDWIDE (In billions of dollars)



GM health care bill tops $60 billion

Cost adds $1,400 per vehicle, hurts competitiveness

By Ed Garsten / The Detroit News

DETROIT — General Motors Corp. is expected to report this week that i obligation for employee and retiree health care topped $60 billion last year. Medicare legislation will do little to reduce the expense. The crushing health care burden with the U.S.

mechanical engineering

feature article

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Striking the proper balance

Correcting rotor imbalances during operation reduces costly downtime and maintenance at industrial sites.

When excessive vibration caused the fan shaft bearings to fail, the repairs cost $8,000 in parts and labor. In the course of a year, fan balancing and upkeep, including the cost of manual balancing, cost U.S. Steel more than $200,000. The one or two weeks of fan maintenance downtime took a toll in lost production.

AIADA DRIVING CHANGE

AMERICAN INTERNATIONAL AUTOMOBILE DEALERS

Sep 6, 09:41 AM | Reuters

New Toyota crash-prevention system monitors driver

AIADA summary

- Toyota Motor Corp. said on Tuesday it has developed the world's first safety feature that monitors a car's operator rather than external dangers on the road and warns a heedless driver if a crash is imminent.
- The new pre-crash safety system will be offered on the new Lexus GS hybrid car to debut in Japan next spring. Japan's top auto maker said it could not disclose whether the feature would be optional or standard, or whether it would be offered overseas.

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When a previously developed safety feature determines a crash is imminent, the monitoring system uses a camera mounted on the steering column and an image-processing computer to determine whether the driver is facing the road. It sends an early warning

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The Needs Are Evident…

THE NATIONAL STRATEGY TO

SECURE CYBERSPACE

FEBRUARY 2003

'Internet .. making most of the nation's essential services and infrastructures work. These computer networks also control physical objects such as electrical transformers, trains, pipeline pumps, chemical vats, radars, and stock markets, all of which exist beyond cyberspace..'

InformationWeek
BUSINESS INNOVATION POWERED BY TECHNOLOGY

Ford, Boeing, Northwestern Join In Nanotechnology Research

Ford Motor Co., Boeing Co. and Northwestern University have formed a research alliance to develop commercia
nanotechnology.

By Anto
Oct. 7,
URL: h

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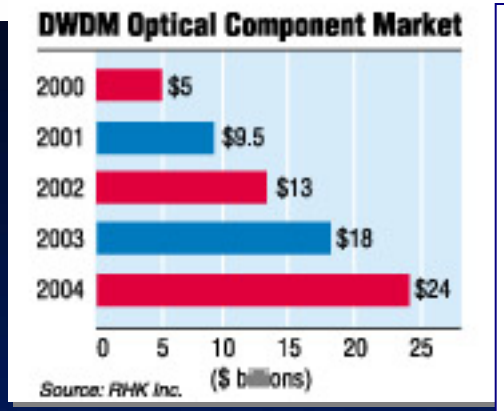
Assembly magazine

Meeting the Fiber Optics Challenge

By Austin Weber / Senior Editor



…telecommunication companies are expected to spend **$1 trillion** updating their networks during the next 20 years. …**Alignment** is extremely critical to fiber optic component assembly. "It's a very precise assembly process," says Heyler. "Precision is measured in **nanometers**. "

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Competing Ideas

Simplifying Measurement Of Complex Shapes

By Wayne Chaneski

Performing dimensional inspections on complex parts has historically been an awkward process that has involved everything from hand gage measurement to sophisticated optical systems. This process

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Manufacturing Trends

- Increasing globalization of the manufacturing enterprise and of markets for manufactured goods
- Compressed cycles of innovation and product introduction
- Increased outsourcing as major manufacturers focus their businesses on design, integration, core fabrication, and assembly
- Increasing competitive pressures to manufacture products with higher quality and better performance at lower cost

Manufacturing Trends (cont.)

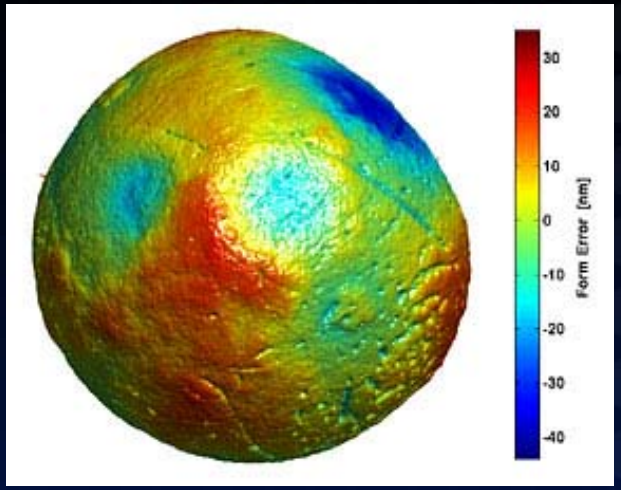
- Potentially transformative effect of new technologies (e.g., nanotechnology) on both manufactured products and manufacturing processes
- Growth of sustainable/green manufacturing to address environmental, resource, health, safety, and other issues
- Spiraling infrastructural costs (employee benefits, health costs, energy, etc.) of U.S. manufacturers

Manufacturing Trends (cont.)

- Increased security vulnerabilities and threats that have the potential to disrupt the extended manufacturing enterprise
- Changing demographics of U.S. workforce (i.e., age, education, background, skills, expectations, etc.)
- Embedded software and IT components as critical attributes of many manufactured products

MEL Strategic Program Planning and Implementation

- Goals of the most recent cycle
  - Make our programs more strategic, flexible, and responsive
  - Ensure the vitality and impact of our technical work
  - Use MEL resources and capabilities most effectively
  - Reaffirm MEL priorities, vision, and direction



Form error of a 100 mm diameter silicon sphere measured by XCALIBIR

Planning Scope

- Direction, scope, organization, and management of all MEL technical work
- All MEL STRS funding
- All management and operational options

  e.g. no programs ⟷ strong programs

Strategic Planning Process – Phase I
Fundamental Considerations and Decisions

- Programs define our strategic directions
- Virtually all technical work managed in programs
  - Measurement Services integrated with supporting research and development
- Pragmatic variations allowed in the nature of programs
  - Orientation: technology area or market sector
  - Size (all must have critical mass)
  - Types:
    - NMI/Measurement Sciences and Services
    - Advanced Manufacturing Technology
    - New Area Development (Entrepreneurial)

Strategic Planning Process – Phase II
Program Selection and Funding

- Program subjects and scopes defined by MEL Management Council (MC) based on:
  - Strategic priorities
  - MEL core competencies
  - Customer impact
  - Alignment with NIST priorities
  - Forward-looking orientation, growth prospects
- Program managers selected
- Initial program funding allocated by MEL director based on strategic considerations
  - 75% of total available funding
  - Gave program managers a planning floor

MEL Core Competencies

- Mechanical and Dimensional Metrology
- Intelligent and Integrated Manufacturing
- Advanced Manufacturing Processes & Equipment

Strategic Planning Process – Phase II
Program Selection and Funding (cont.)

- Program proposals – goals and objectives - prepared by program managers and reviewed by MC
- Final funding (remaining 25%) allocated by MEL director based on actual program proposals
- Final program plans – goals and objectives - prepared by program managers and approved by MC

FY2005 Programs & Managers

Dimensional Metrology	**Steve Phillips**
Mechanical Metrology	**Zeina Jabbour**
Nanomanufacturing	**Michael Postek**
Intelligent Control of Mobility Systems	**Maris Juberts**
Manufacturing Interoperability	**Steve Ray**
Smart Machining Systems	**Alkan Donmez**
Homeland and Industrial Control Security	**Al Wavering**
Manufacturing Metrology & Standards for the Health Care Enterprise	**Ram Sriram**

Program Transition

- Advanced Optics Metrology
- Critical Infrastructure Protection: Cybersecurity of Industrial Control Systems
- Engineering Metrology
- Integrated Nano-to-Millimeter Manufacturing
- Intelligent Control of Mobility Systems
- Intelligent Manufacturing Systems
- Intelligent Open Architecture Control of Manufacturing Systems
- Large-Scale Metrology
- Manufacturing Enterprise Integration
- Manufacturing Simulation and Visualization
- Mechanical Metrology
- Nanometer-Scale Metrology
- Predictive Process Engineering
- Product Engineering
- Shop Floor as a National Measurement Institute
- Smart Machine Tools
- Surface Metrology
- Systems Integration for Manufacturing Applications

TRANSITION

- **Dimensional Metrology**
- **Mechanical Metrology**
- **Nanomanufacturing**
- **Intelligent Control of Mobility Systems**
- **Manufacturing Interoperability**
- **Smart Machining Systems**
- **Homeland and Industrial Control Security**
- **Manufacturing Metrology and Standards for the Health Care Enterprise**

MEL's New Technical Portfolio
Key Characteristics

- 17 programs ⟶ 8 programs
  - With broader scope, program managers can now think more strategically
  - Stronger alignment between programs and division funding and technical work
  - Fewer, larger projects with more focus on key, high-impact subjects (critical mass)
- Programs aligned with strategic directions ⟶ Programs **are** the strategic directions
  - Clearer technical priorities
    - Enhances MEL marketing
- Very interdisciplinary, cross-organizational

Manufacturing Trends

Primary mapping to MEL Programs

Trend	Dimensional Metrology	Mechanical Metrology	Nanoman.	Intelligent Control of Mobility Systems	Mfg. Interop.	Smart Mach. Systems	Homeland & Industrial Ctrl. Security	Mfg. Met. & Standards for the Healthcare Enterprise
	Programs							
Globalization	●	●			●			●
Compressed cycles	●	●	●		●	●		
Outsourcing	●	●			●	●	●	
Competitive pressures	●	●	●	●		●		
Transformative effect of new technologies			●	●				
Sustainable/green manufacturing				●		●		
Spiraling infrastructural costs				●	●			●
Security vulnerabilities							●	
Changing demographics				●		●		
Embedded software and IT				●	●		●	●

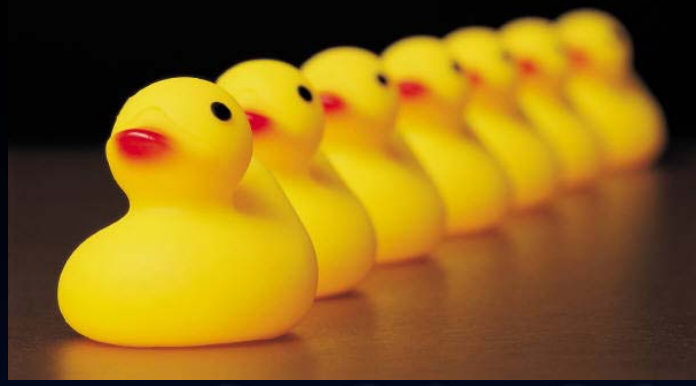
Planning for Continuous Improvement

- MEL's Operational Plan describes high-priority programmatic and management issues for the Laboratory and the actions that will address them
- Prepared and endorsed by the full MEL Management Council
- Four major areas were chosen for emphasis in FY2006:
  - Leadership in Federal Manufacturing Research and Development
  - **Strategic Program Management**
  - MEL Resources and Outreach
  - MEL People

Strategic Program Management Issues for 2006

- Year-one program reviews and adjustments in program goal, direction, and focus, as appropriate
- Planning input via MEL, IWG, and other strategy-level workshops and external exercises
- Impact assessment: qualitative and quantitative metrics
- Maintenance of high-touch outreach and external obligations

In Summary



MEL Programs:

- Are planned strategically
- Respond to critical manufacturing needs and trends
- Are built around MEL/NIST core competencies
- Explore important new application areas for MEL technology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